Amendments to the Claims

This listing of claims will replace all prior versions, and listings, of claims in the application:

Listing of Claims:

Claims 1-14 (canceled)

Claim 15 (new): A method for determining one or more surface profiles of an object, the method comprising the steps of:

moving said object and a plurality of distance sensors relative to one another in a longitudinal direction, each one of said sensors arranged to measure the distance from itself to a surface of said object;

measuring the relative longitudinal motion between said object and said distance sensors;

for each surface, taking a plurality of distance measurements with each one of said sensors as said object and said sensors are moved relative one another, each one of said measurements taken simultaneously by all of said sensors, the sensors thereby providing distance measurement data reflecting a series of measurements, said distance measurement data having a first component relating to the particular surface profile features of said object and a second component relating to rigid body relative motions of said object in the measurement direction relative to said sensors;

analyzing said measurement data to identify said rigid body relative motion component of said data; and

determining said surface profile of said object by separating said rigid body relative motion component of said measurement data from said measurement data, leaving said surface profile feature component, wherein said rigid body motion component of said data is determined by identifying motion fluctuations of said object measured simultaneously at said sensors.

Claim 16 (new): The method of claim 15, wherein said plurality of sensors are arranged on more than one side of said object, to provide data relating to more than one surface of said object.

Claim 17 (new): The method of claim 15, wherein said plurality of sensors are arranged on opposite sides of said object, to provide data relating to two opposite surfaces of said object.

Claim 18 (new): A system for carrying out the method of claim 15 to measure the surface profile of an object independent of relative motions of the object, the system comprising:

a plurality of distance sensors arranged along two or more parallel lines, the sensors arranged to make distance measurements on at least one surface of said object in a measurement direction, the object and the arrangement of said distance sensors being movable relative to one another in a direction different from said easurement direction, each individual sensor making a plurality of distance measurements at pre-determined spaced intervals along the surface of said object when said object is moved relative said arrangement of sensors, thereby enabling substantially similar points on the object to be measured by different sensors within a sequence of measurements;

wherein said pre-determined spaced intervals are smaller than the relative spacings between said sensors.

Claim 19 (new): The system of claim 18 wherein the sequence of the spacings between sensors fixed along different parallel lines are not the same when viewed in the direction of relative motion of the object.

Claim 20 (new): The system of claim 18, wherein the sensors are arranged in a skew-symmetrical pattern of spacings.

Claim 21 (new): A system according to claim 18, further comprising two pluralities of sensors, one for making measurements to each opposite surface of said object, wherein said two pluralities of distance sensors are arranged along two or more parallel lines facing opposite surfaces of said object.

Claim 22 (new). A system according to Claim 18, specifically configured to measure parallel profiles and twist along a surface of an object, wherein said plurality of distance sensors are arranged along two or more parallel lines facing the same surface of said object.

Claim.23 (new). A system according to Claim 18, specifically configured to measure parallel surface profiles, thickness profiles and twist of an object, further comprising a

plurality of sensors arranged along two or more parallel lines, where said distance sensors are arranged along several parallel lines facing the two or more surfaces of said object.

Claim 24 (new). A system according to Claim 18, specifically configured to measure two-dimensional surface shape, where a plurality of line-type distance sensors measure non-parallel lines across one or more surfaces of an object.

Claim 25 (new). A data processing system for processing measurement data in the method of claim 15, the data processing system identifying surface profiles from features that appear in corresponding sensor data in delayed sequence, and any relative rigid-body motions in the measurement direction from features that appear simultaneously in the sensor data, the identification of delayed and simultaneous features achieved by solution of a matrix equation.

Claim 26 (new) The data processing system of claim 26 wherein the matrix equation is of the following types:

$$a_i = u_i + w_i + (0-m)z_i$$
$$b_i = u_{i+p} + w_i + (p-m)z_i/2$$
$$c_i = u_{i+p+q} + w_i + (p+q-m)z_i/2$$
$$d_i = u_{i+p+q+r} + w_i + (p+q+r-m)z_i/2$$

where u_i is the surface height at point i, w_i is the relative displacement in the measurement direction between the object and the sensor array, z_i is the relative rotation of the object relative to the sensor array, and where p, q and r are the numbers of measurement intervals between distance sensors a, b, c and d, respectively, and $m = (p+q+r)/2$;

and

$$\mathbf{A} \cdot \mathbf{f} = \mathbf{g}$$

where f is a vector comprising the surface profile and relative motion results, and g is a vector comprising the measured distance data, and with the matrix contents adjusted to apply to the specific geometrical arrangement of the distance sensors used.

Claim 27 (new) The data processing system according to Claim 27 where the simultaneous equations are arranged in matrix format:

$$A \cdot f = g$$

where matrix A contains the coefficients of the quantities u_i, w_i, and z_i, vector g contains the measured distance data, and vector f contains the desired quantities to be determined .

Claim 28 (new): A data processing system for processing measurement data in the method of claim 15, the data processing system identifying surface profiles from features that appear in corresponding sensor data in delayed sequence, and any relative rigid-body motions in the measurement direction from features that appear simultaneously in the sensor data, the identification of delayed and simultaneous features achieved by solution of "Normal" equations.

Claim 29 (new) The data processing system of claim 28 wherein the "Normal" equations are of the following type:

$$A^T A \cdot f = A^T g$$

and

$$
\left[\begin{array}{ccccccccc|ccccc|ccccc|c}
1 & & & & & & & & & 1 & & & & -1 & & & & & u_1 \\
 & 2 & & & & & & & & 1 & 1 & & & -.5 & -1 & & & & u_2 \\
 & & 2 & & & & & & & 1 & 1 & & & & -.5 & -1 & & & u_3 \\
 & & & 3 & & & & & & & 1 & 1 & & & -.5 & -1 & & & u_4 \\
 & & & & 4 & & & & & 1 & & 1 & 1 & .5 & & -.5 & -1 & & u_5 \\
 & & & & & 3 & & & & 1 & 1 & & 1 & 1 & .5 & & -.5 & & u_6 \\
 & & & & & & 2 & & & & 1 & 1 & & & 1 & .5 & & & u_7 \\
 & & & & & & & 2 & & & & 1 & 1 & & & 1 & .5 & & u_8 \\
 & & & & & & & & 1 & & & & 1 & & & & 1 & & u_9 \\
\hline
 1 & 1 & & & 1 & 1 & & & & 4 & & & & 0 & & & & & w_2 \\
 & 1 & 1 & & & 1 & 1 & & & & 4 & & & & 0 & & & & w_3 \\
 & & 1 & 1 & & & 1 & 1 & & & & 4 & & & & 0 & & & w_4 \\
 & & & 1 & 1 & & & 1 & 1 & & & & 4 & & & & 0 & & w_5 \\
\hline
 -1 & -.5 & & .5 & 1 & & & & & 0 & & & & 2.5 & & & & & z_2 \\
 & -1 & -.5 & & .5 & 1 & & & & & 0 & & & & 2.5 & & & & z_3 \\
 & & -1 & -.5 & & .5 & 1 & & & & & 0 & & & & 2.5 & & & z_4 \\
 & & & -1 & -.5 & & .5 & 1 & & & & & 0 & & & & 2.5 & & z_5
\end{array}\right]
\left[\begin{array}{c} u_1 \\ u_2 \\ u_3 \\ u_4 \\ u_5 \\ u_6 \\ u_7 \\ u_8 \\ u_9 \\ \hline w_2 \\ w_3 \\ w_4 \\ w_5 \\ \hline z_2 \\ z_3 \\ z_4 \\ z_5 \end{array}\right]
=
\left[\begin{array}{c} a_1 \\ a_2 + b_1 \\ a_3 + b_2 \\ a_4 + b_3 + c_1 \\ a_5 + b_4 + c_2 + d_1 \\ b_5 + c_3 + d_2 \\ c_4 + d_3 \\ c_5 + d_4 \\ d_5 \\ \hline a_2 + b_2 + c_2 + d_2 \\ a_3 + b_3 + c_3 + d_3 \\ a_4 + b_4 + c_4 + d_4 \\ a_5 + b_5 + c_5 + d_5 \\ \hline -a_2 - .5b_2 + .5c_2 + d_2 \\ -a_3 - .5b_3 + .5c_3 + d_3 \\ -a_4 - .5b_4 + .5c_4 + d_4 \\ -a_5 - .5b_5 + .5c_5 + d_5 \end{array}\right]
$$

with the matrix contents adjusted to apply to the specific geometrical arrangement of the distance sensors used.

Claim 30 (new): A data processing system according to Claim 25 where result stabilization or smoothing is achieved by using regularization.

Claim 31 (new): A data processing system according to Claim 30 where the regularization type is Tikhonov regularization.

Claim 32 (new): A data processing system according to Claim 25, where evaluation of the surface profile is achieved using a matrix solution method after data collection has been completed.

Claim 33 (new): A data processing system according to Claim 25, where evaluation of

the surface profile is achieved using a progressive solution method that may possibly be initiated before data collection has been completed.

Claim 34 (new). A data processing system according to Claim 33 where the progressive solution involves the Gauss-Seidel or successive over-relaxation methods.